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APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

AUTOMATED WAGERING RECOGNITION SYSTEM

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FIELD OF THE INVENTION

The present invention relates generally to the field of wagering systems and, more particularly, to a system and method for recognizing, recording, and tracking bets at a gaming table with the aid of a computer.

BACKGROUND OF THE INVENTION

The casino and gaming businesses provide special rewards for their valued customers to determine the level of complimentary benefits those customers should receive. Presently, this system is managed by a person such as a pit boss or other casino employee on the casino floor. Such a person keeps detailed notes about certain players and tries to determine the length of time a player gambles, the total amount of money bet in one sitting, the average amount wagered at each bet, and other information about these players. The casino may then determine which players receive benefits such as lodging, meals, and other forms of special treatment.

The system just described depends almost entirely on the alertness and subjective analysis of the casino's floor observer or pit boss. Despite his best efforts, the pit boss can only observe a limited number of players at a time, and thus large casinos require quite a number of floor observers to cover the entire casino. Such a system is expensive, and by its very nature subject to mistakes in not gathering all of the available information to fully implement and exploit the system.

Fishbine *et al.*, in U.S. Patent No. 5,781,647 suggested a system that assists gambling operations at casinos in accurately tracking the gambling habits of its customers. The Fishbine *et al.* system tracked the length of the time a player played, amount of money he bet, and the average amount he wagered at each bet in order to determine incentives and complimentary benefits (free meals, limo, room, *etc.*) which should be offered to the right players. Such a system was also used to determine a player's pre-established credit rating.

However, the Fishbine *et al.* system apparently used a dedicated system for each player and was thus very expensive and inefficient for a large gambling operation. What is really needed is a system that can track the gambling of many players simultaneously in one system, and thereby perform the supervisory duties of one or more floor supervisors in a casino. Further, the Fishbine *et al.* system used an edge detection algorithm to sense the edge of each chip in a stack of gambling chips to determine the amount of a bet and such an algorithm has proved prone to errors in making such a determination. The Fishbine *et al.* also made no allowance for the effective placement of video cameras in order to capture an accurate image of the gambling area. Thus, there is also a need for a computer driven visual system for the gaming industry to more accurately determine the amount of a bet and to transmit information about a plurality of such bets to a central location for use and analysis.

SUMMARY OF THE INVENTION

The system of the present invention addresses these and other needs and drawbacks in the art to automatically track every bet made on a casino table game where the players gambling chips are placed in a predetermined area on the table surface for certain selected casino games. This allows the system to identify the player making the bet and assign the wager amount to his record.

The system includes a system of electronic computer hardware and software that can acquire a video (analog or digital) image of a stack of gambling chips placed in the betting area on the casino table. This is done by placing a color video camera or other video imager at the top level of a gaming table directly in front of each betting area and sending a video signal into an image grabber board located in a central computer unit. The position of the camera is critical for the analysis procedure.

The system and method of this invention can also quickly switch between individual players' bets at a specific table to acquire video signals between cameras on a table and from table to table. This feature is important for the acquisition and analysis of the gambling habits of a plurality of players. To accomplish this task, the system includes a video multiplexer having a plurality (such as, *e.g.*, eight) video inputs and one video display. These multiplexers may preferably be linked together to send a video signal from any camera in the pit to one central computer for image acquisition and analysis.

The system may also initiate the video read and capture from the active cameras on the casino table with a trigger device. This device can

be any kind of electronic button, foot pedal, mouse pad, *etc.*, controlled, for example, manually by a dealer.

Another feature of the present invention includes registering a client and designating his seat position at the table. This may be accomplished in a variety of easily implemented ways, such as for example with a commercial magnetic card swipe reader with an attached keypad for data input.

The system can also send data from the trigger, magnetic card reader, and keypad into the central computer. This is carried out using a computer serial board designed to accept data from the trigger, magnetic card reader, and keypad. These boards can be daisy-chained together and data can be sent through a serial cable from any table in the pit to one central computer for identification and processing.

In order to eliminate spurious signals, the system can also hide and shelter the cameras on the table. The system includes a table platform to sit on top of the casino table, allowing the player to set his chips, drinks, and other items on top of the platform. The platform is lined with a light source (rope light, neon light, fluorescent light, or other light) to illuminate the chip stack with a consistent light. This feature prevents a shadow effect on the bottom chips and also gives a more consistent color scheme or pattern for analysis.

Finally, the system can store data into a player tracking database program for viewing and analysis. This permits the casino to accurately track the playing of many players simultaneously in real time, and thus eliminates the inaccuracies and subjective analysis of casino floor observers.

These and other features and objects of this invention will be apparent to those skilled in the art from a review of the following detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an overall schematic diagram of the gaming system of this invention.

Figure 2 is a perspective view of a gaming table including the cameras and lighting aspects of this invention.

Figure 3 is a plan view of the gaming table of Figure 2.

Figure 4 is an electrical schematic diagram illustrating the preferred arrangement for a plurality of video multiplexers arranged in tandem.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Figure 1 depicts an overall system diagram of the computer assisted wagering recognition system of this invention, designated in Figure 1 by the numeral **10**. The system **10** includes a central computer **12** and accompanying monitor **14**. The system further includes a plurality of gaming tables **16**, of which eight are shown in Figure 1, although the system may include any number of such gaming tables. Further details of a gaming table **16** are shown below with regard to Figures 2 and 3.

In a preferred embodiment, the system **10** further includes a video multiplexer **18** at each table, or associated with each table, regardless of where the multiplexer **18** is physically located. The multiplexer **18**, which is described in greater detail below, receives inputs from a plurality of individual gaming sites, most clearly embodied in a video input from one

gaming seat, as shown in Figures 2 and 3. In a first alternative embodiment, the plurality of multiplexers **18** are joined together in series, or daisy-chained, so that data from a first table **20** is passed along to a second table **22**, as so on until the data from all of the tables is passed along to the central computer **12**, such as for example into an RS-232 input of the computer. In a second alternative embodiment, the system **10** further includes a polling system **30**, which signals each of the multiplexers **18** in turn, assembles a data packet of information including data from all of the tables **16**, and forwards this data packet along to the central computer **12**.

Figures 2 and 3 show further details of a gaming table **16** in accordance with this invention. Figure 2 shows a perspective view, and Figure 3 shows a plan view of the table **16**. The table **16** includes a platform **40** which is elevated slightly above a playing surface **42**. The platform is used by players to hold chips, drinks, and any other items they wish to place on it so that such items are out of the playing surface **42**. Underneath the platform **40** are situated a plurality of cameras or video imagers **44**, one camera or imager for each player, and, more specifically, one camera for each of plurality of wagering locations **46**, on the surface **42**. Each camera has a field of view **48** to view all of a wagering location **46** to which the camera is dedicated. Each camera **44** is preferably recessed under the platform **40** (Figure 3) to prevent extraneous visual images from being received by the camera. This is particularly true because an array of lights **50** is mounted on an inside wall **52** of the platform **40** (Figure 2) or in a recess **51** beneath the platform (Figure 3) to illuminate the wagering locations **46** with a uniform and consistent light to minimize shadow effects associated with gambling chips. The lighting on the table also helps to maintain a consistent frequency spectrum of light

illuminating gambling chips, regardless of background lighting changes. The lights **50** preferably comprise fluorescent lights, but they may be incandescent or even flexible neon, infrared, and so on. The light from the lights **50** is projected outward onto the wagering locations **46**, and away from the lenses of the cameras **44** to more tightly control the image received by the cameras **44** of the chips placed on the wagering locations **46**. Further, the light spectrum of the lights **50** is especially selected to be unobtrusive to those sitting around the table, while maximizing the accuracy of the image captured by the cameras.

Note also that a rear edge **54** is preferably flush with the peripheral edge of the gaming table. The platform may be custom made to accommodate any desired gaming table dimension.

Pit Operation Procedure

In operation of this invention, a player sits at a casino table **16**, and receives a designation, such as table 1, seat 1. He may hand the dealer his player's card, which preferably include a magnetic stripe which uniquely identifies the player, and provides access to biographical data regarding that player, including gambling history, and available line of credit, if any. The card is swiped into a magnetic card reader **60** and on a keypad **62** (Figure 1) the dealer indicates to the central computer **12** the seat number the player is sitting in. Although the card reader **60** and keypad **62** are only shown at one table in Figure 1, each table may have such equipment installed.

Swiping a particular card and keying in a specific seat designation sends a data signal (name and any other information on the card) to the

central computer **12** and clocks the player at table 1, seat 1, and the camera **44** in front of his betting circle is activated. If the player does not have a player's card, the dealer registers the player as a guest with the keypad and the above procedure is performed as previously described. The dealer will also have the option to input the player's buy-in on the keypad **62**. The keypad may also be used for a variety of other purposes by the dealer for communicating information to the central computer, such as for example certain codes which may be transmitted to a supervisor to relay information about customer, his bets, and other information.

Immediately prior to a deal, the dealer presses a trigger button **64** and a signal is sent into the central computer **12** telling the system to prepare to capture the video streams from the active cameras **44** on table 1. The central computer **12** sends a signal to the multiplexer **18** associated with table 1 and tells the multiplexer **18** to send the video signal from table 1, seat 1 (and any other active seats at the table one by one as controlled by the multiplexer **18**) into the computer's image grabber board for capture and analysis. This procedure takes only nanoseconds to complete.

After the image is captured, it is loaded into RAM within the central computer **12** for analysis. The data from the image is then stored in a data base in the central computer **12** under the player's record. Now the data can be retrieved in player tracking software for viewing and analysis.

Operation of the Player Analysis Program

The method of the present invention begins with initializing the system. The central computer is programmed to carry out the method

without operator intervention, with certain interrupts entered as required, such as reading in player card data and designating table/seat values as valid when a player sits to play.

The program begins by reading all chip sample values from a central database, assigning visible characteristics to each denomination of chip. The system them reads operational variable values from a central database in the central computer **12** to fine tune the interpolation algorithm, skew analysis, chip sample height nominal values, maximum chips in stack to process, and chip matching method by seat, table, casino, or any combination of these values.

Next, the system initializes all video multiplexer boards through the parallel port into the central computer. At this point, the system is now ready to begin tracking player activity and to receive inputs from the tables, such as trigger inputs from the dealers at the various tables and video inputs from the cameras.

Once a dealer initiates a signal at his assigned table, preferably from the keypad **62**, the system calls a process to read all active seats at the triggered table. The system then recursively calls the video multiplexer **18** for that table to cycle through all active seats at the table and store a binary representation of each video picture in RAM at the central computer **12**.

10. Based on the initialization sequence previously described, the system then finds a theoretical chip stack of n chips (where n is the predetermined maximum number of chips to read in a stack) from each stored video image in RAM and selects a desired sample area based on the predetermined field of view **48**. Fishbine *et al.*, U.S. Patent No. 5,781, 647, teaches an edge

detection scheme to determine the value of bets, but we have found this technique to be inadequately accurate for the purpose of gathering precise data regarding the amount of each bet from a plurality of wagering locations at a plurality of tables and in real time.

5a. Once the desired sample area has been determined, the system uses any appropriate interpolation algorithm to find the contact point or line between the bottom edge of the bottom chip in the stack based upon contrast, width, and steepness of the bottom chip against the table surface. The system calculates the inherent skew in the stack introduced by the camera location to allow for varying chip heights based upon each chip's theoretical placement in the stack. With the camera positioned a variable distance from the chip stack (but constant, known height above the surface **42**), the stack's distance from the camera will determine the height of each theoretical chip in the stack. The vertical skew is estimated using a logarithmic curve calculation based on variables inherent with each seat including variable chip stack distances, chip height, and camera lens size. The formula to calculate the curve of vertical skew is:

(1) $y = (b^* ((m1^{x1})^*(m2^{x2})^*(...)))$

where:

b = constant of 1

m = chip height at x pixel location

x = pixel location of bottom chip table contact point

Y is solved as the width of the theoretical chip currently being processed by solving the formula:

$$y = b * (m^x)$$

where:

b = y intercept of the line

m = slope of the line

x = pixel location of bottom chip table contact point

Next, the system calculates each chip's height from the chip stack using the skew algorithm and selects a center sample height of n * m pixels (where n is the sample height in pixels and m is the sample width in pixels). Then, it compares each theoretical sample chip area against the stored base samples to determine each chip's monetary value. In this step, the system performs a statistical analysis comparison of each sample area utilizing mean, median, standard deviation, average, minimum, and maximum values calculated from the multiple image component planes of the sample area of each chip. The planes may be Red, Green Blue (RGB) or Hue, Saturation, and Lightness (HSL) or any combination of these. Alternatively, the system may perform any appropriate particle analysis correlation algorithm to determine a unique pattern on each sample area correlated against a set of assigned patterns with associated monetary values. The system may also use a combination of these algorithms to determine chip stack value.

Next, using previously stored calibration data, the system finds the stored base sample that best matches the theoretical chip sample area within a predetermined tolerance factor to assign a monetary value to the bottom-most chip. If a base sample area does match and a monetary value is assigned, the process continues up to the next higher chip in the stack. If no base sample area matches the theoretical sample area within the

tolerance constraint, then the theoretical stack is assumed to have ended and no more theoretical chips are processed in the theoretical stack. In such a case, processing continues at the next active seat image.

Once the system has a match to the store data value, it stores the monetary value of the theoretical chip stack to the central database for the table/seat combination being analyzed.

Multiplexer Specifications

The video multiplexer (VM) **18** is a standard National Television Standards Committee (NTSC) (or any other appropriate format) video signal routing device with 8 inputs and 1 output. The VM may be used with 7 other VM's connected in series, as shown in Figure 1, or the VM's may be coupled in a star arrangement in the alternative embodiment of Figure 1.

Once all 8 VM's are connected to each other with control from a PC and video inputs from NTSC cameras, they are capable of choosing from any of 57 video signals. Typically, the seven cameras per board will be chosen before accessing cameras on a different board.

The VM's are designed to be daisy-chained together, as previously described. A first connection **70** couples the central computer **12** to a first VM **72**. The VM's address themselves dynamically so no special setup is needed to tell the first VM that it is the first VM. The one connected to the PC will always be the first with an address of 000_2 to 111_2. Figure 4 depicts the preferred data communications arrangement for the multiplexers **18**.

The principles, preferred embodiment, and mode of operation of the present invention have been described in the foregoing specification. This invention is not to be construed as limited to the particular forms disclosed, since these are regarded as illustrative rather than restrictive. Moreover, variations and changes may be made by those skilled in the art without departing from the spirit of the invention.